CLAIMS

1. A rubber-reinforcing fiber comprising an organic fiber or an inorganic fiber made of an non-metallic inorganic compound, the organic fiber or the inorganic fiber being provided with a coating layer of 10 Å to 40 μm thick, and the coating layer containing at least one metal and/or metal compound selected from the group consisting of cobalt, zinc, copper, titanium, silver, nickel and compounds of the preceding metals.

2. The rubber-reinforcing fiber according to claim 1, wherein the coating layer contains metallic cobalt and/or cobalt oxide in an amount of 5 % by weight or more in elemental cobalt basis.

3. The rubber-reinforcing fiber according to claim 1, wherein the coating layer contains metallic cobalt and/or cobalt oxide in an amount of 20 % by weight or more in elemental cobalt basis.

4. The rubber-reinforcing fiber according to claim 1, wherein the coating layer contains metallic cobalt and/or cobalt oxide in an amount of 50 % by weight or more in elemental cobalt basis.

5. The rubber-reinforcing fiber according to any one of claims 1 to 4, wherein the organic fiber or the inorganic fiber is substantially non-bundled.

6. The rubber-reinforcing fiber according to any one of claims 1 to 4, wherein the organic or inorganic fiber substantially non-bundled is a fiber aggregate comprising a single filament, a multifilament of ten pieces or less of filaments, or a parallel filament of ten pieces or less of adjoining filaments.

7. The rubber-reinforcing fiber according to claim 6, wherein a space between adjoining filaments of the parallel filament of ten pieces or less of adjoining filaments is $(\sqrt{2}-1)d$ wherein d is a diameter of filament.

8. The rubber-reinforcing fiber according to claim 6 or 7, wherein the fiber aggregate has a permeability to dry plating particles, which allows the plating particles passing through the fiber aggregate to form a plating layer having a maximum thickness of 10 Å or more on a film disposed on the back surface of

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the fiber aggregate with a distance of 1 mm or less, when measured by carrying out a dry plating treatment under conditions such that a plating layer having a maximum thickness of 40 μm or less is formed on a film disposed on the front surface of the fiber aggregate.

9. The rubber-reinforcing fiber according to claim 6 or 7, wherein the fiber aggregate has a permeability to dry plating particles, which allows the plating particles passing through the fiber aggregate to form a plating layer having a minimum thickness of 10 Å or more on a film disposed on the back surface of the fiber aggregate with a distance of 1 mm or less, when measured by carrying out a dry plating treatment under conditions such that a plating layer having a maximum thickness of 40 μm or less is formed on a film disposed on the front surface of the fiber aggregate.

10. The rubber-reinforcing fiber according to any one of claims 1 to 9, wherein the organic fiber is a polyester fiber, a polyamide fiber, a poly(vinyl alcohol) fiber, an acrylic fiber, a polyolefin fiber, a polyimide fiber, a poly(phenylene sulfide) fiber, a poly(ether ether ketone) fiber, a polybenzazole fiber, a viscose fiber, or a solvent-spun cellulose fiber; and the inorganic fiber made of a non-metallic inorganic compound is a carbon fiber, a ceramic fiber or a glass fiber.

11. The rubber-reinforcing fiber according to any one of claims 1 to 10, wherein the organic fiber comprises a polyester monofilament cord made of poly(ethylene terephthalate) or mainly made of poly(ethylene terephthalate), and satisfies all the following requirements:

(a) intrinsic viscosity: 0.85 dl/g or higher;

(b) birefringence: 0.17 or higher;

(c) crystal orientation: 0.88 or higher;

(d) density: 1.32 g/cm^3 or higher;

(e) fineness: 1000 to 9000 dtex;

(f) tenacity: 5.2 gf/dtex or higher; and

(g) initial modulus: 50 gf/dtex or higher.

12. The rubber-reinforcing fiber according to any one of claims 1 to 11,

wherein the organic fiber is a polyester short fiber, a polyamide short fiber, a poly(vinyl alcohol) short fiber, an acrylic short fiber, a polyolefin short fiber, a polyimide short fiber, a poly(phenylene sulfide) short fiber, a poly(ether ether ketone) short fiber, a polybenzazole short fiber, a viscose short fiber, or a solvent-spun cellulose short fiber.

13. A method for producing a rubber-reinforcing fiber, comprising a step of dry-plating a coating layer of a thickness of 10 Å to 40 μm on an organic or inorganic fiber which is substantially non-twisted, the coating layer containing at least one metal and/or metal compound selected from the group consisting of cobalt, zinc, copper, titanium, silver, nickel and compounds of the preceding metals.

14. The method according to claim 13, wherein the organic or inorganic fiber is subjected to a plasma cleaning or plasma etching treatment for removing impurities prior to the formation of the coating layer.

15. The method according to claim 13 or 14, wherein the organic or inorganic fiber is further subjected to a processing for twisting or cutting into short fiber after dry-plating the coating layer.

16. The method according to any one of claims 13 to 15, wherein the coating layer is continuously formed by subjecting the organic or inorganic fiber comprising a single filament or ten pieces or less of filaments to the dry-plating treatment or to the dry-plating treatment successively after the plasma treatment while allowing the fiber to continuously run by pulling the fiber in its length direction.

17. The method according to any one of claims 13 to 16, wherein the coating layer is formed by subjecting a plurality of the organic or inorganic fibers arranged at intervals to the dry-plating treatment or to the dry-plating treatment successively after the plasma treatment while allowing the fibers to continuously run by pulling the fibers in their length direction, each fiber comprising a single filament or ten pieces or less of filaments, thereby forming the coating layer on a plurality of the fibers simultaneously and continuously.

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18. The method according to any one of claims 13 to 15, wherein a fiber aggregate comprising entangled plurality of filaments each substantially not twisted with an adjoining filament is subjected to the dry-plating or to the dry-plating treatment successively after the plasma treatment to form the coating layer having a thickness of 10 Å to 40 μm; and then the dry-plated fiber aggregate is processed into short fibers.

19. The method according to claim 13 or 14, wherein a single short fiber filament or a plurality of short fiber filaments are subjected to the dry-plating treatment or subjected to the dry-plating treatment successively after the plasma treatment while keeping the short fiber filament or filaments moving on a stationary or running support, thereby forming the coating layer on the short fiber filament or filaments.

20. The method according to any one of claims 13 to 19, wherein the dry plating is a physical vapor deposition by vacuum deposition or ion plating.

21. The method according to any one of claims 13 to 19, wherein the dry plating is a physical vapor deposition by sputtering.

22. A rubber–fiber composite comprising the rubber-reinforcing fiber as defined in any one of claims 1 to 12 and a rubber composition.

23. A vulcanizable rubber article comprising the rubber–fiber composite as defined in claim 22.

24. The vulcanizable rubber article according to claim 23, which is a pneumatic tire.

25. The vulcanizable rubber article according to claim 24, wherein the pneumatic tire has a carcass constructed by a carcass ply reinforced with the rubber–fiber composite.

26. The vulcanizable rubber article according to claim 24, wherein the pneumatic tire has a bead portion comprising a bead wire and a bead filler, in which the bead filler is reinforced with the rubber–fiber composite.

27. A pneumatic tire which comprises a tread portion, a pair of side portions connected to both lateral edges of the tread portion and a pair of bead portions

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disposed inside of each side portion, and which is reinforced by a carcass ply having carcass ply cords which were arranged along the radial direction of the tire and a belt ply which surrounds the carcass ply and is disposed inside of the tread portion, wherein the carcass ply cord is made of the rubber-reinforcing fiber as defined in claim 11.

28. A pneumatic tire comprising a bead wire disposed in a bead portion; a carcass ply which comprises a rubber-coated cord layer made of a plurality of parallel cords, each end of the carcass ply being turned up at the bead portions and fixed to the bead portion; and a bead filler disposed radially outward of the bead wire, wherein the bead filler comprises the short fiber as defined in claim 12 having a length of 100 mm or less and a diameter of 0.0001 to 0.8 mm.

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